REMARKS

Claim 1, 2, 4, 5, 6 and 7 have been amended to recite that the laser beam is directly applied to the side surface of the noble metal tip. Support for the amendments can be found at, for example, Figs. 3 and 4. Entry of this Amendment is respectfully requested, and caims 1-12 are pending.

Response to Claim Rejections Under § 103

Claims 1 and 2 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 07-022155 to Oshima in view of U.S. Patent No. 6,215,235 to Osamura and further in view of U.S. Patent Application Publication No. 2002/0105254 to Hori et al in view of JP 09-106880 to Abe et al.

Claims 4 and 5 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Oshima in view of Osamura, in view of U.S. Patent No. 4,540,910 to Kondo et al, and further in view of Hori in view of Abe.

Claims 6 and 7 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Oshima in view of Osamura, in view of U.S. Patent No. 5,465,022 to Katoh, and further in view of Hori in view of Abe.

Claims 3 and 9 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Oshima in view of Osamura, in view of Hori in view of Abe and further in view of U.S. Patent No. 4,700,103 to Yamaguchi et al.

Claims 8 and 10 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Oshima in view of Osamura in view of Kondo, in view of Hori, in view of Abe and further in view of Yamaguchi.

Claims 11 and 12 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Oshima in view of Osamura in view of Katoh, in view of Hori, in view of Abe and further in view of Yamaguchi.

Applicants respectfully traverse.

The present claims recite a method for producing a spark plug whereby welding of the noble metal tip is performed in such a manner that a laser beam is applied on the whole circumference of the flange portion of the noble metal tip obliquely at an angle and is directly applied to the side surface of the noble metal tip. Namely, the laser beam is applied obliquely to the electrode by applying the laser beam directly to the side surface of the noble metal tip thereby forming a weld having a higher noble metal content (e.g., 60% or even higher), such that the noble metal tip and the electrode have a sufficiently high welding strength therebetween.

Oshima fails to disclose or suggest a method whereby the laser is applied obliquely to the noble metal tip and the electrode. Rather, Oshima discloses a method whereby the laser beam is applied to the boundary between the noble metal tip and the electrode in a direction perpendicular to the side surface of the noble metal tip. *See,* Figures 4 and 5. Thus, the noble metal tip and the electrode are equally exposed to the laser beam. Since the electrode has a lower melting point as compared to the noble metal tip, the electrode is melted to a greater extent as compared to the noble metal tip.

Hori discloses a spark plug comprising: (a) a center electrode having a tip; (b) a ground electrode having a center electrode-opposed surface facing the tip of the center electrode; (c) a noble metal member having a given length and a first and a second end opposed to each other through the length, wherein the noble metal member is joined at the first end to the center electrode-opposed surface of the ground electrode by laser welding so as to oppose the second

end to the tip of the center electrode through a spark gap; and (d) a fused portion that forms a weld of the noble metal member and the ground electrode formed by materials of the ground electrode and the noble metal member melted together. *See,* paragraph [0011]. Hori further discloses that the joining of the noble metal chip 45 to the tip 43 of the ground electrode 40 is achieved by laser welding. *See,* paragraph [0099].

The method of laser welding, according to Hori, is accomplished by (1) radiating six laser beams simultaneously to the corner 45b at fixed angular intervals (i.e., 60°) without moving them, or (2) radiating a laser beam to the corner 45b six times at an angular interval of 60° while turning the chip 45 and the ground electrode 40 together about a longitudinal center line of the chip 45. The number of laser spots may be determined as a function of the size or shape of the chip 45. *See,* paragraph [0101] and Figs. 3(a), 3(b), 4(a) and 4(b). The noble metal chip 45 has a given length and a lateral sectional area (i.e., a circular traverse area in this embodiment) of 0.1 mm^2 to 0.6 mm^2.

The laser welding method of Hori results in the formation of the fused portions 44 made up of the materials of the chip 45 and the ground electrode 40 melted together, wherein the fused portions 44 partially overlap each other around the chip 45. In addition, the method results in unfused portions 46. Thus, Hori fails to disclose or suggest a method of irradiating the whole circumference of a flanged portion of the noble metal tip, such that the noble metal content in a position far by about 0.05 mm inward a molten portion as specified becomes 60% or higher. Specifically, the above-noted limitation relating to noble metal content is only met for the combination of using a noble metal tip having a flange portion and obliquely irradiating the whole circumference of the flanged portion as claimed in claims 1, 2, 4, 5, 6 and 7.

Abe discloses a spark plug for an internal combustion engine comprising a center electrode (3), an earth electrode (4) and a the noble metallic chip (5, 5) welded to at least one of the center electrode (3) and the earth electrode (4), wherein a protruding portion (3c, 4c) is formed around an outer periphery of the noble metallic chip (5, 5) by forcibly pressing the noble metallic chip (5, 5) to part of the electrode (3, 4). Abe further discloses that the noble metallic chip (5, 5) is held by the electrode (3, 4) through this protruding portion (3c, 4c).

The method of laser welding, according to Abe is accomplished by converging the laser beam L to the protruding portion 3c or its vicinity of the center electrode 3 at an incident angle of 45° with respect to the axis of the center electrode 3. According to Abe, the noble metallic chip 5 is irradiated by the laser beam L through the protruding portion 3c. In other words, the laser beam L is used to melt the protruding portion 3c, and to melt the tip 3a of the center electrode 3 and the central portion of the side surface of the noble metallic chip 5 in the vicinity of the protruding portion 3c. Further, the melted portions are mixed with each other since the protruding portion 3c of the melted the center electrode 3 covers the melted the noble metallic chip 5.

Abe fails to disclose or suggest the combination of using a noble metal tip having a flange portion, obliquely irradiating the whole circumference of the flange portion and directly applying the laser beam to the side surface of the noble metal tip as presently claimed.

Accordingly, even if one skilled in the art were to modify the method of Oshima to utilize the welding method of Hori and Abe, the resulting combination still would not achieve the present invention.

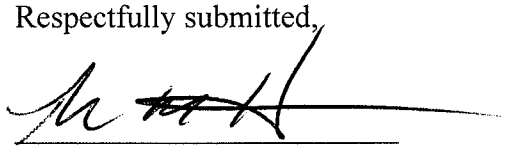
Each of Osamura, Kondo, Katoh and Yamaguchi fails to make up for the above noted deficiencies of Oshima in view of Hori and Abe. Thus, Oshima, Osamura, Hori, Abe, Kondo,

Katoh and Yamaguchi fail to render obvious the present claims. Accordingly, withdrawal of the foregoing rejections is respectfully requested.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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